

Think **SMALL** in a **BIG** Way

A Teacher's Activity Guide for the STARDUST Mission
for Grades 5-8



Brought to you by
Jet Propulsion Laboratory

and

The STARDUST Outreach Team:

Challenger Center for Space Science Education

The JASON Foundation for Education

The Kirkpatrick Science and Air Space Museum at Omniplex

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“Comet Cratering”—Challenger Center for Space Science Education.

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“The Incredible Edible Comet”—Challenger Center developed this activity based on a recipe from Kirkpatrick Science and Air and Space Museum at Omniplex, Oklahoma City, Oklahoma.

“Famous Comets”—developed by Challenger Center

“Voyage of Discovery”—this activity is based on Challenger Center’s *Voyages Across the Nation*, a partnership between Challenger Center, the Smithsonian Institution and NASA.

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“Egg Drop Sample Return Capsule”—adapted from NASA Spacelink.

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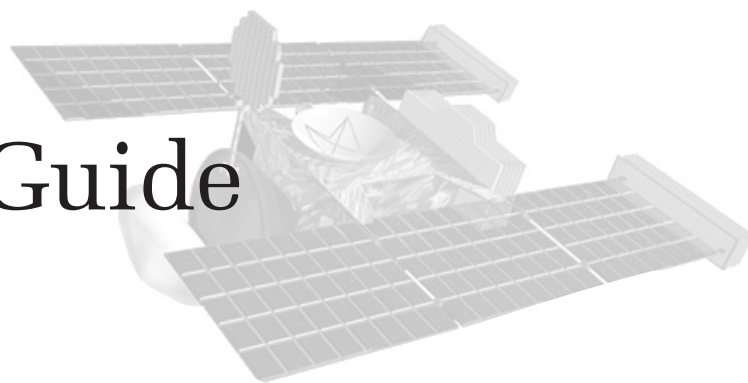
“Paint by the Numbers”—from the NASA publication *Space Based Astronomy Teacher’s Guide*.

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About This Guide



This guide focuses on parts of the Solar System that do not get much attention: the small bodies of the Solar System, namely asteroids, meteoroids, and comets. These small bodies play a significant role in the formation of the Solar System, and they can leave a lasting impact in their own right. For more information about the basics of asteroids, meteoroids, and comets and their significance, see the section Think SMALL in a Big Way on page 3.

Small bodies tie into the *National Science Education Standards* by the National Research Council and *Curriculum and Evaluation Standards for School Mathematics* by the National Council of Teachers of Mathematics. To see how the activities have been correlated to the national standards, consult the Activity Matrix on page ix.

Each section contains background information and activities that support the section topic. The guide is broken into sections that touches upon various facets of a mission to explore Comet Wild 2 (pronounced “Vilt,” after its discoverer). The first dedicated U.S. mission to a comet is the STARDUST mission scheduled to launch in February of 1999. For more information about STARDUST see page 5. Teachers can use this guide with great flexibility, focusing on any aspect of a mission that most suits his or her curriculum, current events, etc. By picking at least one activity from each section, students gain a breadth of understanding about mission planning and execution couched in a real-world context of an actual mission, STARDUST.

The first section starts by exploring the current thinking about comet anatomy and structure. The second section part looks at where comets reside in the Solar System and their orbits. The third section examines some of the intricacies of navigating a spacecraft to a comet, followed by the fourth section that deals with spacecraft design and testing. Finally, students investigate aspects of spacecraft technology for studying Comet Wild 2. This includes transmitting data and designing a device to capture particles to bring back for Earth studies.

Fact Sheets are located at the end of the guide since several activities make use of the same ones. For the teacher selecting just one or two activities to do in class, these Fact Sheets can be used with any activity to overview basic concepts. The vocabulary at the back of the guide is another such handy reference. It contains concise definitions of key vocabulary for small bodies. As missions progress, updates occur continuously on the Internet. The latest information can be found on the NASA mission homepages listed in the Resources section at the end of the activity guide.

While teachers are welcome to pick and choose among the activities, we have structured the guide so that those teachers, who are so inclined, can simulate the STARDUST mission. We suggest kicking off a STARDUST unit with the teacher demonstration Cookin' up a Comet and other activities from Comet Basics. Hold a “mission briefing” tasking students to work in teams to design and implement the STARDUST mission. Use activities from each unit to address different aspects of the mission. The following is a logical sequence of mission events and corresponding activities.

MISSION EVENT	ACTIVITY
Mission briefing	STARDUST Fact Sheet
Spacecraft design	Candy Model Spacecraft
Comet orbit	Elliptical Orbits
Spacecraft navigation	Navigation Simulation
Comet rendezvous	Cookin' up a Comet
Data transmission	Paint by the Numbers
Particle capture	Aerogel Clay Collector
Sample return	Egg Drop Sample Return

**Activity Matrix
for National Science Education Standards
and Curriculum and Evaluation Standards for School Mathematics
Grades 5-8**

	NATIONAL SCIENCE STANDARDS Unifying Concepts and Processes Systems, order, and organization Evidence, models, and explanation Change, constance, and measurement Evolution and equilibrium Form and function Science as Inquiry Abilities necessary to do scientific inquiry Understanding about scientific inquiry Physical Science Properties and changes of properties in matter Motions and forces Transfer of energy Earth and Space Science Structure of the Earth system Earth's history Earth in the Solar System Science and Technology Abilities of technological design Understanding about science and technology Science in Personal and Social Perspectives Science and technology in society History and Nature of Science Science as human endeavor Nature of science History of science National Mathematics Standards Mathematics as Problem Solving Mathematics as Communication Mathematics as Reasoning Mathematical Connections Number and Number Relationships Computation and Estimation Patterns and Functions Algebra Geometry Measurement																											
Think SMALL in a Big Way																												
Comet Cratering																												
Mysterious Seas and Skies																												
Comet Basics																												
Cookin' Up a Comet																												
Incredible Edible Comet																												
Famous Comets																												
Comet Origins and Travels																												
Voyage of Discovery																												
Elliptical Orbits																												
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